Active Project (2015 - 2017)

# Context-Augmented Robotic Interaction Layer (CARIL) Phase II Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

## ABSTRACT

CHI Systems and the Institute for Human Machine Cognition have teamed to create a human-robot interaction system that leverages cognitive representations of shared context as a basis for a fundamentally new approach to human-robotic interaction. This approach centers on a framework for representing context, and for using context to enable robot adaptive decision-making and behavior. The framework is called CARIL (the Context-Augmented Robotic Interaction Layer). Context is an important part of human-human interaction. Unfortunately, context is often overlooked when designing robotic systems. The challenge is to translate high-level concepts, such as teamwork and collaboration, into specific requirements that can be implemented within control algorithms, interface elements, and behaviors. During Phase I, CHI Systems developed a proof-of-concept CARIL implementation and applied it to a notional simulated robot in a simple station model. This simulation demonstrated CARIL's feasibility by demonstrating how it gave the simulated robot a capability to reason about its context to avoid spatial interference with astronaut activities and tasks.

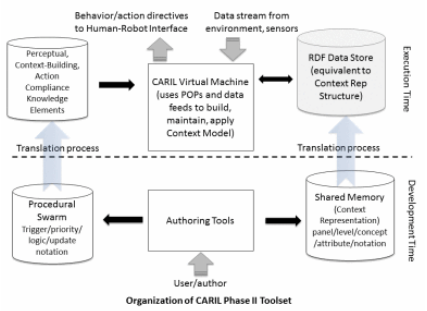
## ANTICIPATED BENEFITS

### To NASA funded missions:

Potential NASA Commercial Applications: CARIL allows a robot to have "action compliance" – an ability to adapt its behavior to that of human astronauts around it, by using a human-like model of context. Action Compliance, the behavioral analog of physical-interaction force compliance concept, is an enabling capability. Its post-applications are to the Robonaut-2 program at Johnson Space Center, the Free-flying robot (SPHERES) program at Ames Research Center, and as an embeddable, enabling technology, to all future robotic or robotic programs or future missions requiring robots or robotic vehicles.

### To the commercial space industry:

Potential Non-NASA Commercial Applications: Military Robot

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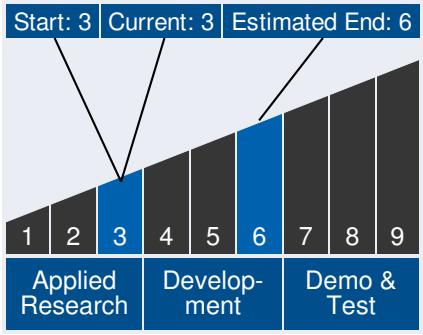


### Management Team

**Program Executives:**

- Joseph Grant
- Laguduva Kubendran

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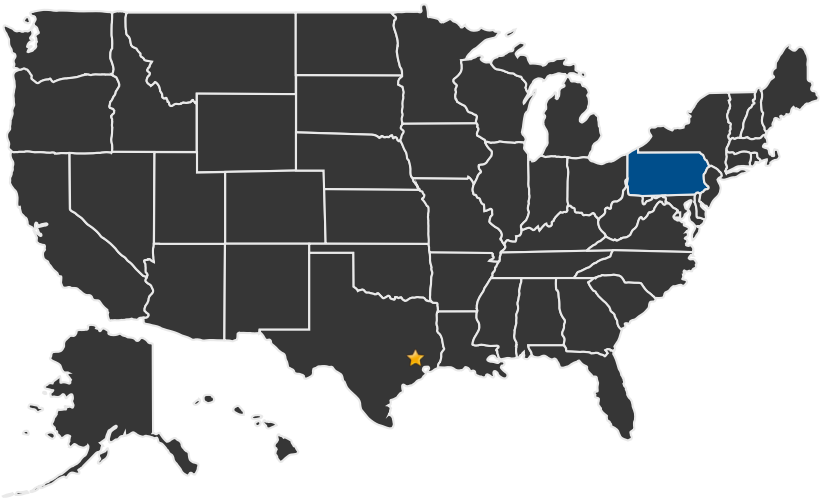
and Uninhabited Robot Vehicles (URV) Markets – provide increased robotic autonomy and enhanced human-robotic control to military URV applications. Civil/Commercial Robot and Uninhabited Robot Vehicles (URV) Markets – provide increased human-robot collaboration and adaptive behaviors to business whose future strategy relies on the use of robots and drones to optimize manufacturing, supply-chain and distribution processes.

## U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

**Lead Center:**
Johnson Space Center

**Other Organizations Performing Work:**

- CHI Systems, Inc. (Plymouth Meeting, PA)

## PROJECT LIBRARY

### Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/18201)

## Management Team *(cont.)*

**Program Manager:**

- Carlos Torrez

**Principal Investigator:**

- Wayne Zachary

## Technology Areas

**Primary Technology Area:**
Human Health, Life Support, and Habitation Systems (TA 6)
└ Human Health and Performance (TA 6.3)
└ Human Factors (TA 6.3.4)
└ Human-Robotic Interfaces for Increased Autonomy (TA 6.3.4.7)

**Secondary Technology Area:**
Robotics and Autonomous Systems (TA 4)
└ Human-System Interaction (TA 4.4)
└ Distributed Collaboration and Coordination (TA 4.4.5)

## DETAILS FOR TECHNOLOGY 1

**Technology Title**

Context-Augmented Robotic Interaction Layer (CARIL) Phase II